E32-433T37S

Product Specification

433MHz 5W LoRa Wireless Module



成都亿佰特电子科技有限公司

Chengdu Ebyte Electronic Technology Co.,Ltd.

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1. Introduction

1.1 Brief Introduction

The E32-433T37S is a wireless serial port module (UART) based on SEMTECH's high-performance RF chip, with a variety of transmission methods, working in the (410 ~ 441MHz) frequency band (default 433MHz), LoRa spread spectrum technology, TTL level Output, supports 4.5V - 15V supply voltage.



E32-433T37S adopts a new generation of LoRa spread spectrum technology, which is faster, lower power consumption, and smaller than other traditional solutions; it supports air wake-up, wireless configuration, and other functions, and can provide customized development services.

1.2 Features

- Developed a new LoRa spread spectrum modulation technology based on SEMTECH's high-performance RF chip, which brings longer communication distance and better anti-interference ability;
- Support FEC forward error correction to improve communication stability;
- Support wake-up over the air, that is, ultra-low power consumption function, suitable for battery-powered applications;
- Support fixed-point transmission, broadcast transmission and other transmission modes;
- Support deep sleep within the full power supply range, and the power consumption of the whole machine in this mode is less than 10uA;
- Support global license-free ISM 433MHz frequency band;
- The module has built-in PA+LNA, and the communication distance can reach 25km under ideal conditions;
- The parameters are saved after power-off, and the module will work according to the set parameters after power-on;
- Efficient watchdog design, once an exception occurs, the module will automatically restart and continue to work according to the previous parameter settings;
- Support data transmission rate of 2.4K ~ 19.2kbps;
- Support 4.5~15V wide voltage power supply, and the power output of 37dBm can be guaranteed in the whole power supply range;
- Industrial-grade standard design, supporting long-term use at -40 ~ +85℃.
- The maximum power of the module can reach 5W (37dBm), and the transmission is farther and more stable;
- The module has built-in undervoltage and overvoltage warning functions and a built-in warning LED;
- The module has a built-in over-temperature protection function, which will automatically stop sending when the maximum temperature of the module is exceeded;
- Matrix pads are reserved at the bottom of the module to facilitate heat dissipation for secondary development;

1.3 Application

- Home security alarm and remote keyless entry;

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- Smart home and industrial sensors, etc.;
- Wireless alarm security system;
- Building automation solutions;
- Wireless industrial grade remote control;
- Healthcare products;
- Automotive industry applications.

II. Specification and parameter

2.1 Limit parameters

Main parameters	Performance		Remark
	Minimum value	Maximum value	
Power supply voltage（V）	4.5	15	Exceeding 15V may permanently burn the module
Blocking power（dBm）	-	10	High-power radio frequency do not communicate at close range
Working temperature（℃）	-40	+85	Industrial grade

2.2 Working parameters

Main parameters		Performance			Remark
		Minimum value	Typical value	Maximum value	
Working voltage (V)		4.5	5~12V	15	≥4.5V can guarantee the output power, the lower the voltage, the greater the supply current
Communication level (V)		-	3.3	-	There may be a risk of burning when using a 5V level, and a level conversion circuit is required
Working temperature (℃)		-40	-	85	Industrial grade design
Working frequency band (MHz)		410	-	441	Support ISM frequency band
Power	5V emission current (mA)	2900	3100	3300	Tested under 50 ohm impedance, the impedance mismatch may cause the current to be too large, please provide a power supply with at least 3.5A

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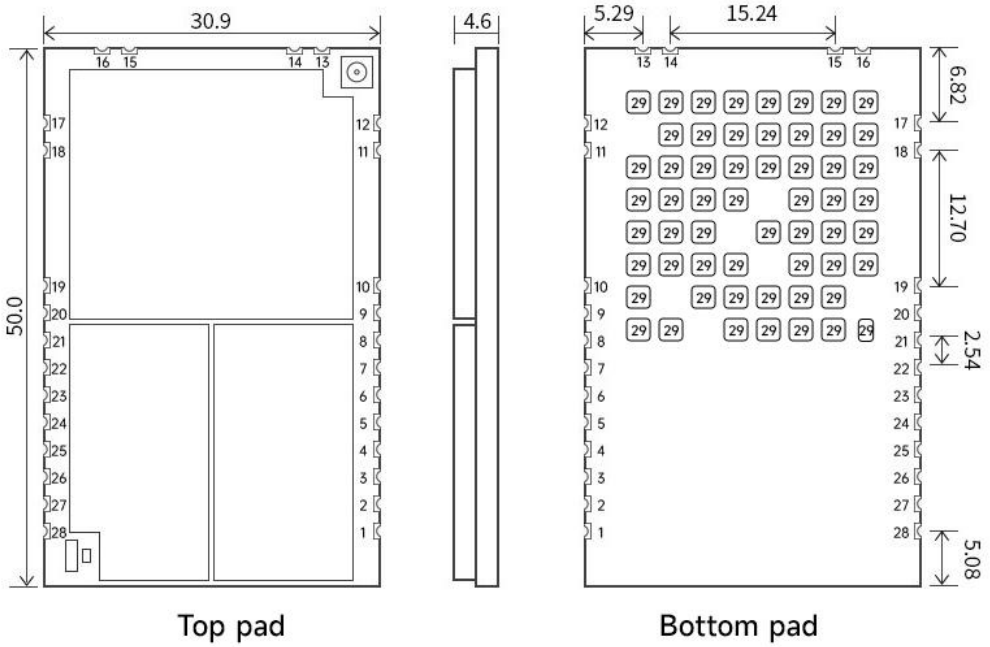
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co					output when using 5V power supply
ns u m pti on	12V emission current (mA)	900	1100	1300	Tested under 50 ohm impedance, impedance mismatch may lead to excessive current, please provide at least 1.5A output power supply when using 12V power supply.
	Receive current (mA)	38	43	48	Supply voltage：12V DC
	Sleep current (uA)	-	2	-	Software shutdown
Maximum transmit power (dBm)		36	37	37.5	-
Receiving sensitivity (dBm)		-125	-126	-127	Air rate 2.4 kbps
Air rate (bps)		2.4k	2.4k	19.2k	User Programmable Control
Reference distance		25km			Clear sky, antenna gain 5dBi, antenna height 2.5 meters
Launch length		58 Byte			The maximum capacity of a single package will be automatically divided into packages after exceeding.
Cache capacity		512 Byte			-
Modulation		LoRa			A new generation of LoRa modulation technology
Communication Interface		UART serial port			TTL level
Encapsulation		SMD			SMD
Interface		2.54mm Stamp hole			
Dimensions		50*30.9mm			
RF interface		IPEX/stamp hole			The characteristic impedance is about 50 ohms

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III. Size and pin definition



Pin number	Pin name	Pin Orientation	Remark
1	GND	Input	Module ground wire
2	GND	Input	Module ground wire
3	VCC	Input	Positive reference of module power supply, voltage range: 4.5~15V DC
4	VCC	Input	Positive reference of module power supply, voltage range: 4.5~15V DC
5	RESET	Input	Module reset pin
6	AUX	Output	Used to indicate the working status of the module; the user wakes up the external MCU, and outputs a low level during the initialization of the power-on self-test; (can be suspended).
7	TXD	Output	TTL serial port output, connected to external RXD input pin;
8	RXD	Input	TTL serial port input, connected to the external TXD output pin;
9	M1	Input (very weak pull-up)	Cooperate with M0 to determine the 4 working modes of the module (not floating, if not used, it can be grounded)
10	M0	Input (very weak pull-up)	Cooperate with M1 to determine the 4 working modes of the module (not floating, if not used, it can be grounded)
11	GND	Input	Module ground wire

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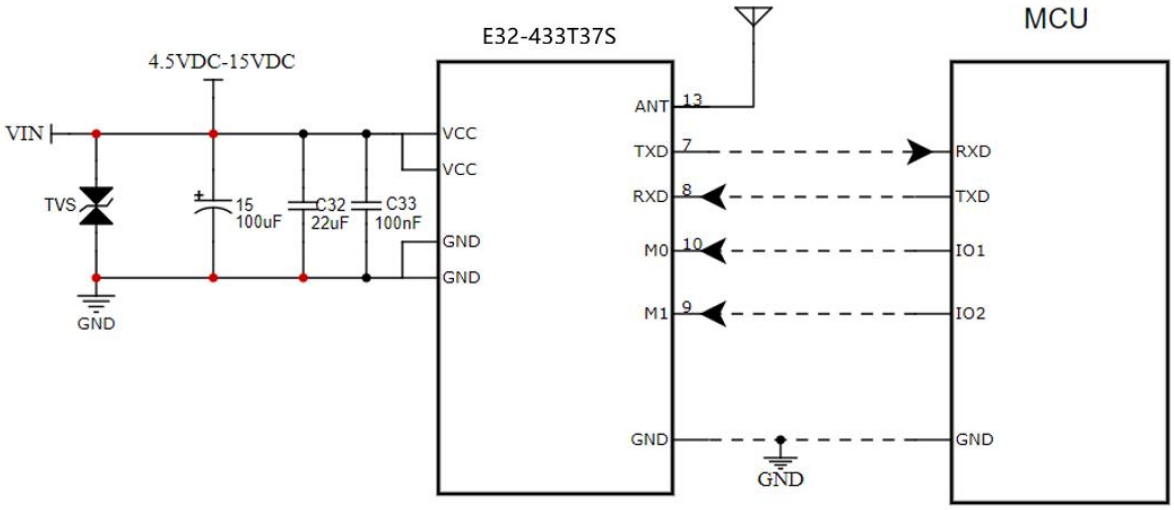
12	GND	Input	Module ground wire
13	ANT	Output	Antenna interface (high-frequency signal output, 50 ohm characteristic impedance)
14	GND	Input	Module ground wire
15	GND	Input	Module ground wire
16	GND	Input	Module ground wire
17	GND	Input	Module ground wire
18	GND	Input	Module ground wire
19	GND	Input	Module ground wire
20	STATE	Output	Module status indication output, if it is not used, it can be handled in the air.
21	485-EN	Input /Output	The enable control pin of the external 485 chip can be suspended if it is not used.
22	NC	-	Don't worry, just leave it in the air.
23	NC	-	Don't worry, just leave it in the air.
24	NC	-	Don't worry, just leave it in the air.
25	SWDIO	-	Don't worry, just leave it in the air.
26	SWCLK	-	Don't worry, just leave it in the air.
27	GND	Input	Module ground wire
28	3.3V	-	Don't worry, just leave it in the air.-
29	NC	-	The bottom of the module is reserved with matrix solder pads. Users need to ground them to assist in the heat dissipation of the module. For detailed dimensions, please refer to the PCB packaging diagram in the relevant download section of the Ebyte official website.

Note: The module must be connected to a 50 ohm impedance antenna when sending, and sending without load may cause permanent damage to the module! ! !

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IV. Recommended Wiring Diagram



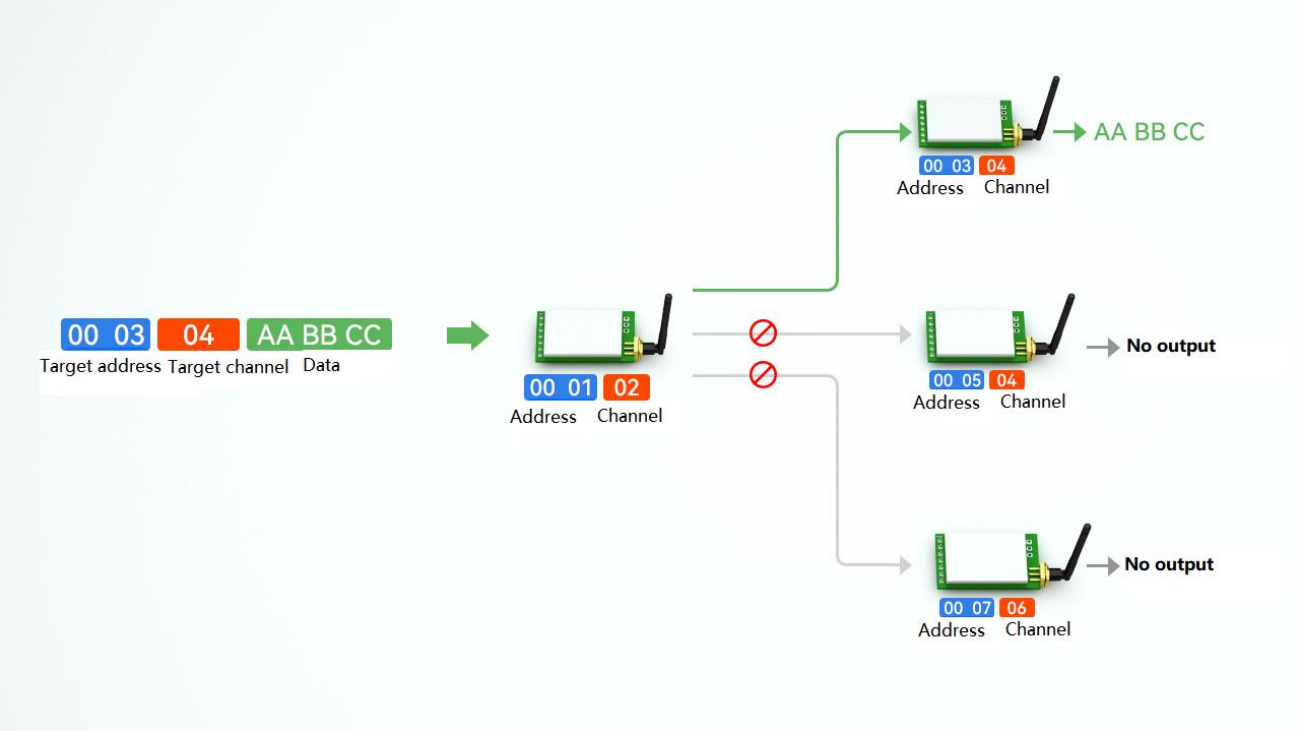
No.	Brief description of the connection between the module and the microcontroller (the above picture takes the STM8L microcontroller as an example)
1	The wireless serial port module is TTL level, please connect it with TTL level MCU.
2	Use a 5V microcontroller, please perform level shifting.
3	A capacitor of no less than 47uF should be added to the power input terminal, and the ESR of the capacitor should be as low as possible to increase the stability of the module.
4	Power supply protection devices can be added according to actual needs.

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V. Detailed Function

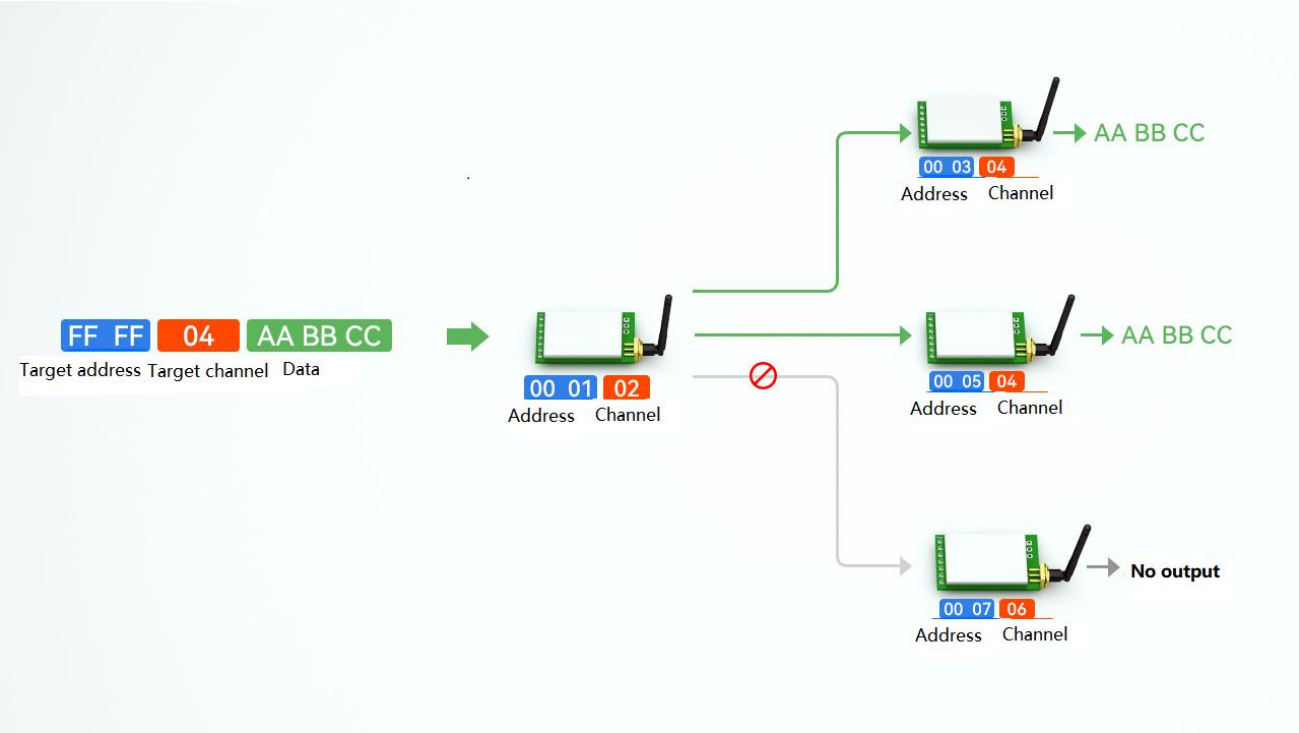
5.1 Fixed point transmission



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5.2 Broadcast transmission



5.3 Broadcast address

- Example: Set the module A address to 0xFFFF and the channel to 0x04.
- When module A is used as a transmitter (same mode, transparent transmission mode), all receiving modules under the 0x04 channel can receive data to achieve the purpose of broadcasting.

5.4 Listen address

- Example: Set the module A address to 0xFFFF and the channel to 0x04.
- When module A is used as a receiver, it can receive all the data under the 0x04 channel to achieve the purpose of monitoring.

5.5 Module reset

- After the module is powered on, AUX will output low level immediately, perform hardware self-check, and set the working mode according to user parameters;
- During this process, the AUX keeps the low level, and after the completion, the AUX outputs the high level, and starts to work normally according to the working mode composed of M1 and M0; Therefore, the user needs to wait for the rising edge of AUX as the starting point for the normal operation of the module.

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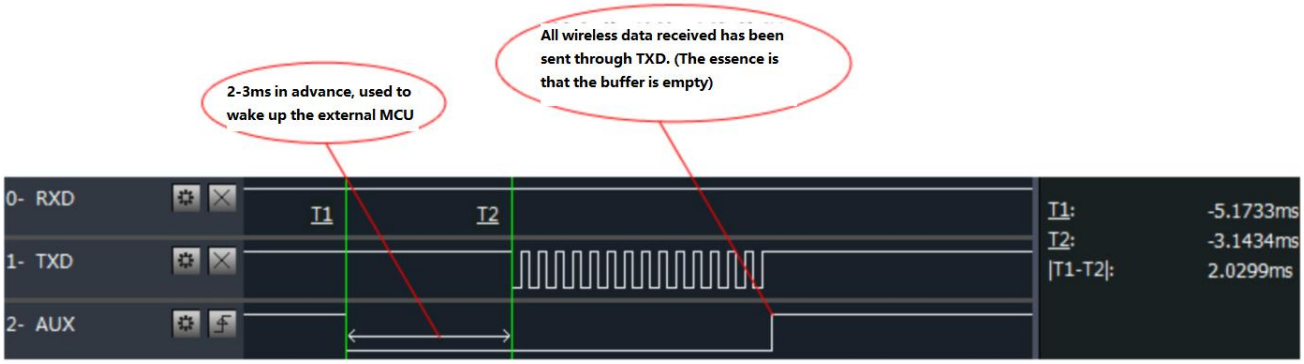
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5.6 AUX Detailed Description

- AUX is used for wireless transceiver buffer indication and self-check indication
- It indicates whether the module has data that has not been transmitted wirelessly, or whether the received wireless data has not been sent through the serial port, or the module is in the process of initializing and self-checking.

5.6.1 Serial data output indication

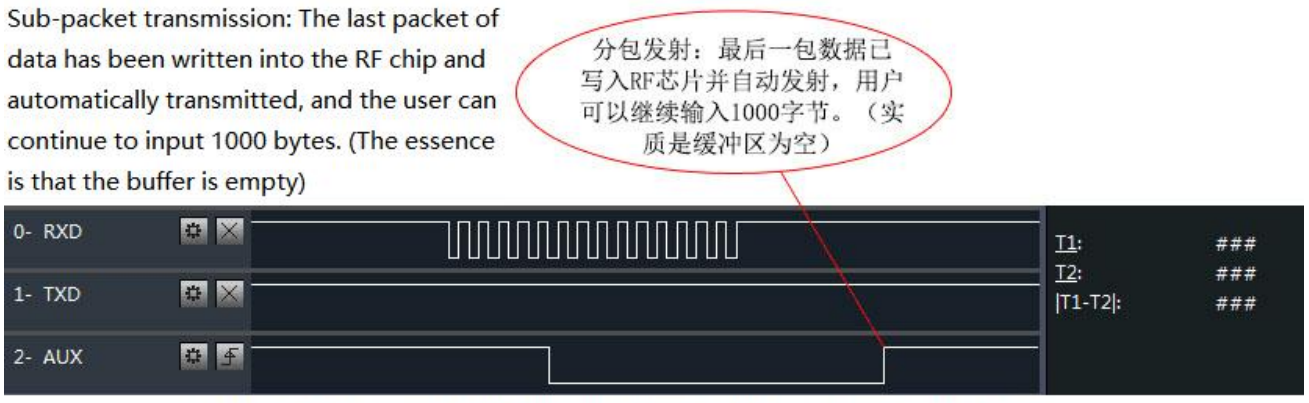
- Used to wake up the external MCU in sleep;



The timing diagram of AUX pin when the module serial port sends out data.

5.6.2 Wireless transmission indication

- The buffer is empty: The data in the internal 512-byte buffer is written to the wireless chip (automatic packetization);
  When AUX=1, the user continuously initiates data less than 1000 bytes without overflow;
  When AUX=0, the buffer is not empty: The data in the internal 512-byte buffer has not yet been written into the wireless chip and the transmission is started. At this time, the module may be waiting for the end of user data to time out, or it may be transmitting wireless packets.
  [Note]: When AUX=1, it does not mean that all serial port data of the module has been transmitted wirelessly, the last packet of data may be being transmitted.



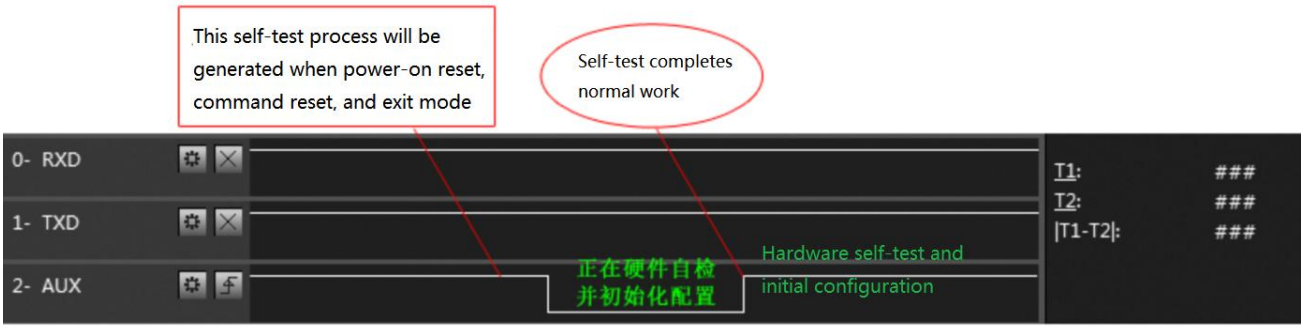
The timing diagram of AUX pin when the module receives serial port data.

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5.6.3 Module is being configured

- Only when resetting and exiting sleep mode;



AUX pin timing diagram during self-test

5.6.4 Precautions

No.	AUX Precautions
1	For the above functions 1 and 2, the output low level is given priority, that is, if any one of the output low level conditions is met, the AUX outputs the low level; When all low level conditions are not satisfied, AUX outputs high level.
2	When AUX outputs a low level, it means that the module is busy, and the working mode detection will not be performed at this time; When the module AUX outputs a high level within 1ms, the mode switching will be completed.
3	After the user switches to the new working mode, the module will enter this mode at least 2ms after the rising edge of AUX; if AUX is always at a high level, the mode switching will take effect immediately.
4	When the user enters other modes from mode 3 (sleep mode) or during the reset process, the module will reset the user parameters, during which AUX outputs a low level.
5	Due to the characteristics of the LoRa modulation method, the information transmission delay is much longer than that of FSK. It is recommended that customers do not transmit large amounts of data at low airspeeds to avoid communication abnormalities caused by data loss due to data accumulation.

5.7 Detailed explanation of abnormal working status log printing

5.7.1. The STATE indicator/status indication pin will flash/level according to the specific abnormal working state according to the table below.

Abnormal working condition	Threshold for judging abnormal status	LED blinking
Undervoltage	Supply voltage<4.5V±0.2V	500ms flash once / level flip
Overvoltage	Supply voltage>15V±0.2V	1s blink once/level flip
Overheat	Module temperature >120°C	2s blink once/level flip
Overpressure and Overheating	Supply voltage >15V and module temperature >120°C	Always on

5.7.2. The module will temporarily turn off the radio frequency transmission function when it is in an abnormal working state, and it will restart and start the transmission after returning to the normal working state.

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5.7.3. When the module is in an abnormal state, it will print a circular log every 500ms (can be turned on/off) to inform the user of the current abnormal working state. The format of the printed log is shown in the following table:

Abnormal working condition	Print log format
Undervoltage	FF FF FF 01
Overvoltage	FF FF FF 02
Overheat	FF FF FF 03
Overpressure and overheating	FF FF FF 04

Exception log printing configuration: use the hex command C3 03 01 01 to enable the exception log printing, use the hex command C3 03 01 00 to disable the exception log printing; read the exception log printing configuration status through the hex command C4 03 01, the default is 00 (off).

VI. Operating mode

The module has four working modes, which are set by pins M1 and M0; the details are shown in the following table:

Mode（0-3）	M1	M0	Mode Introduction	Remarks
0 transmission mode	0	0	Serial port open, wireless open, transparent transmission	Receiver must be mode 0, 1
1 WOR mode	0	1	Open the serial port and open the wireless; The only difference from mode 0: before the data packet is sent, the wake-up code is automatically added, so that the receiver working in mode 2 can be woken up.	Receiver can be mode 0 Receiver can be mode 1 Receiver can be mode 2
2 Power saving mode	1	0	The serial port reception is closed, and the wireless is in the air wake-up mode. After receiving the wireless data, open the serial port to send the data.	The transmitter must be in mode 1; it cannot transmit in this mode
3 Deep sleep	1	1	The module enters dormancy and can receive parameter setting commands	See working parameters for details

6.1 Mode switch

No.	Remarks
1	● Users can combine M1 and M0 with high and low levels to determine the working mode of the module. The 2 GPIOs of the MCU can be used to control the mode switching; ● After changing M1 and M0: if the module is idle, after 1ms, it can start to work according to the new mode; ● If the module has serial port data that has not been transmitted wirelessly, the new working mode can only be entered after the transmission is completed; ● If the module receives the wireless data and sends out the data through the serial port, it needs to be sent out before it can enter the new working mode; ● Therefore, the mode switching can only be effective when the AUX output is 1, otherwise the switching will be delayed.
2	● For example: if the user continuously inputs a large amount of data and switches the mode at the same time, the mode switching operation is invalid at this time; the module will process all the user data before performing the new mode detection; ● So the suggestion is: Detect the output state of the AUX pin, wait for 2ms, after output the high level, and then switch mode.

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3	● When the module is switched from other modes to sleep mode, if there is data that has not been processed yet; the module can only enter sleep mode after processing these data (including receiving and sending). This feature can be used for fast sleep to save power consumption; for example: the transmitter module works in mode 0, the user initiates serial port data "12345", and then does not need to wait for the AUX pin to be idle (high level), and can directly switch to sleep mode, The main MCU of the user is put to sleep immediately, and the module will automatically go to sleep within 1ms after sending all the user data wirelessly, thereby saving the working time of the MCU and reducing power consumption.
4	● Similarly, this feature can be used for any mode switching. After the module processes the current mode event, it will automatically enter the new mode within 1ms; thus saving the user's work of querying AUX, and achieving the purpose of fast switching ; For example, switching from transmit mode to receive mode; the user MCU can also go to sleep in advance before the mode switch, and use the external interrupt function to obtain the AUX change, so as to switch the mode.
5	● This operation mode is very flexible and efficient, and is completely designed according to the user's MCU operation convenience, and can reduce the workload of the entire system as much as possible, improve system efficiency, and reduce power consumption.

6.2 Normal Mode (Mode 0)

Type	When M0 = 0, M1 = 0, the module works in mode 0
Emission	The module receives user data from the serial port, and the length of the wireless data packet transmitted by the module is 58 bytes. When the amount of data input by the user reaches 58 bytes, the module will start wireless transmission. At this time, the user can continue to input the data to be transmitted. When the bytes that the user needs to transmit are less than 58 bytes, the module waits for 3 bytes. If there is no user data to continue to input, it is considered that the data is terminated. At this time, the module sends all data packets through wireless. When the module receives the first user data, AUX outputs low level, when the module puts all the data into the RF chip and starts transmitting, AUX outputs high level; at this time, it indicates that the last packet of wireless data has been received After starting the transmission, the user can continue to input data up to 512 bytes; the data packet sent through mode 0 can only be received by the receiving module in mode 0 and mode 1.
Receive	The module has always turned on the wireless receiving function, and can receive data packets from mode 0 and mode 1; After receiving the data packet, the module AUX outputs low level, and after a delay of 5ms, it starts to send wireless data through the serial port TXD pin. After all wireless data is output through the serial port, the module outputs AUX high level.

6.3 WOR Mode (Mode 1)

Type	When M0 = 1, M1 = 0, the module works in mode 1
Emission	The conditions for the module to start data packet transmission and the AUX function are the same as mode 0; the only difference is: the module will automatically add a wake-up code before each data packet, and the length of the wake-up code depends on the wake-up time set in the user parameters. The purpose of the wake-up code is to wake up the receiving module working in mode 2; therefore, the data transmitted in mode 1 can be received by modes 0, 1, and 2.
Receive	Equivalent to mode 0.

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6.4 Power Saving Mode (Mode 2)

Type	When M0 = 0, M1 = 1, the module works in mode 2
Emission	The module is in a dormant state, the serial port is closed, and cannot receive serial data from an external MCU, so this mode does not have a wireless transmission function.
Receive	In mode 2, the transmitter must work in mode 1; Monitor the wake-up code regularly. Once a valid wake-up code is received, the module will continue to be in the receiving state and wait for the entire valid data packet to be received; Then AUX outputs low level, after a delay of 5ms, open the serial port and send the received wireless data through TXD, and AUX outputs high level after completion; The wireless module continues to enter the working state of "sleep-monitoring" (polling); By setting different wake-up times, the module has different receiving response delays (up to 2s) and average power consumption (minimum 240uA); users need to strike a balance between communication delay time and average power consumption.

6.5 Deep Sleep Mode (Mode 3)

Type	When M0 = 1, M1 = 1, the module works in mode 3
Emission	Unable to transmit wireless data.
Receive	Unable to receive wireless data.
Configuration	Sleep mode can be used for module parameter setting, use serial port 9600, 8N1, and set module working parameters through specific instruction format.
Note	When entering other modes from sleep mode, the module will reconfigure parameters. During the configuration process, AUX keeps low level; after completion, it outputs high level, so it is recommended that users detect the rising edge of AUX.

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VII. Register Read and Write Control

7.1 Instruction format

In configuration mode (mode 2: M1=1, M0=0), the list of supported commands is as follows (when setting, only 9600 and 8N1 formats are supported):

No.	Instruction format	Detailed Description
1	C0+ working parameters	Send C0+5 bytes of working parameters in hexadecimal format, a total of 6 bytes, which must be sent continuously (saved after power-off).
2	C1+C1+C1	Send three C1 in hexadecimal format, and the module returns the saved parameters, which must be sent continuously.
3	C2+ working parameters	Send C2+5 bytes of working parameters in hexadecimal format, a total of 6 bytes, which must be sent continuously (not saved when power off).
4	C3+C3+C3	Send three C3s in hexadecimal format, and the module returns version information, which must be sent continuously.
5	C4+C4+C4	Send three C4 in hexadecimal format, the module will generate a reset and must be sent continuously.

7.2 Read working parameters

Command format	Detailed Description
C1+C1+C1	In sleep mode (M0=1, M1=1), send a command (HEX format) to the module serial port: C1 C1 C1, the module will return the current configuration parameters, such as: C0 00 00 1A 17 44.

7.3 Reset command

Command format	Detailed Description
C4+C4+C4	In sleep mode (M0=1, M1=1), send a command (HEX format) to the module serial port: C4 C4 C4, the module will generate a reset; during the reset process, the module performs self-test, and AUX outputs low level. After the reset is completed, AUX outputs a high level, and the module starts to work normally. At this point, a mode switch can be performed or the next command can be initiated.

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7.4 Parameter register description

No.	Name	Description				Remark
0	HEAD	Fixed 0xC0 or 0xC2, indicating that the frame data is a control command				Must be 0xC0 or C2 C0: The set parameters will be saved after power off. C2: The set parameters will not be saved after power off.
1	ADDH	Module address high byte (default 00H)				00H-FFH
2	ADDL	Module address low byte (default 00H)				00H-FFH
3	SPED	7	6	Serial check digit		The serial port mode of both communication parties can be different
		0	0	8N1 (default)		
		0	1	8O1		
		1	0	8E1		
		1	1	8N1 (equivalent to 00)		
		5	4	3	TTL serial port rate（bps）	The baud rate of the two communication parties can be different. The serial port baud rate has nothing to do with the wireless transmission parameters and does not affect the wireless transmission and reception characteristics.
		0	0	0	The serial port baud rate is 1200	
		0	0	1	The serial port baud rate is 2400	
		0	1	0	The serial port baud rate is 4800	
		0	1	1	The serial port baud rate is 9600 (default)	
		1	0	0	The serial port baud rate is 19200	
		1	0	1	The serial port baud rate is 38400	
		1	1	0	The serial port baud rate is 57600	
		1	1	1	The serial port baud rate is 115200	
		2	1	0	Universal Wireless Air Rate（bps）	The lower the air rate, the farther the distance, the stronger the anti-interference performance, and the longer the sending time. The air wireless transmission rate of both communicating parties must be the same.
		0	0	0	The air rate is 2.4k	
		0	0	1	The air rate is 2.4k	
		0	1	0	The air rate is 2.4k (default)	
		0	1	1	The air rate is 4.8k	
		1	0	0	The air rate is 9.6k	
		1	0	1	The air rate is 19.2k	
		1	1	0	The air rate is 19.2k（Same as 101）	
		1	1	1	The air rate is 19.2k（Same as 101）	
4	CHAN	General model				
		7	6	5	Reserved	Write 0
		Communication channel				00H-1FH, corresponding to 410~441MHz
		4~0, corresponding to (410MHz+CHAN * 1MHz), default 17H (433MHz)				
5	OPTION	7	Fixed-point sending enable bit (like MODBUS)			When it is 1, the first 3 bytes of each user data frame are used as high and

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		0	Transparent transfer mode			low addresses and channels. When transmitting, the module changes its own address and channel, and restores the original settings after completion.
		1	Fixed-point transfer mode			
		6	IO driver mode (default 1)			This bit is used to enable the module's internal pull-up resistor. The open-drain mode has stronger level adaptability, and an external pull-up resistor may be required in some cases.
		1	TXD, AUX push-pull output, RXD pull-up input			
		0	TXD, AUX open circuit output, RXD open circuit input			
		5	4	3	Wireless wake up time	The transceiver modules all work in mode 0, the delay time is invalid and can be any value; The transmitter works in mode 1 and will continue to transmit the calling code for the corresponding time; The receiver works in mode 2, this time refers to the receiver's monitoring interval (wireless wake-up), and can only receive data from the transmitter working in mode 1.
		0	0	0	250ms (default)	
		0	0	1	500ms	
		0	1	0	750ms	
		0	1	1	1000ms	
		1	0	0	1250ms	
		1	0	1	1500ms	
		1	1	0	1750ms	
		1	1	1	2000ms	
		2	FEC switch			After turning off FEC, the actual data transmission rate increases, but the anti-interference ability is weakened, and the distance is slightly shorter, please choose according to the actual application; Both communication parties must be enabled or disabled.
		0	Disable FEC error correction			
		1	Turn on FEC error correction (default)			
		1	0	Transmitting power (approximate value)		The module is fixed power 37dBm
		0	0	37dBm (default)		
		0	1	37dBm		
		1	0	37dBm		
		1	1	37dBm		

Give an example (the meaning of the serial number 3 "SPED" byte).								
The binary bits of the byte	7	6	5	4	3	2	1	0
Concrete value (user config)	0	0	0	1	1	0	1	0
Representative meaning	Serial check digit 8N1		The serial port baud rate is 9600			Air rate is 2.4k		
Corresponding hexadecimal	1				A			

7.5 Factory parameters

Model	**Factory default parameter value：C0 00 00 1A 17 44**						
Module model	Frequency	Address	Channel	Air Rate	Baud Rate	Serial Format	Transmit Power
E32-433T37S	433MHz	0x0000	0x17	2.4kbps	9600	8N1	5W

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VIII. Hardware Design

- It is recommended to use a DC regulated power supply to power the module, the power supply ripple coefficient should be as small as possible, and the module should be grounded reliably;
- Please pay attention to the correct connection of the positive and negative poles of the power supply, such as reverse connection may cause permanent damage to the module;It is recommended to design and add an anti-reverse connection circuit.
- Please check the power supply to ensure that it is between the recommended power supply voltages. If it exceeds the maximum value, the module will be permanently damaged;
- Please check the stability of the power supply, the voltage should not fluctuate greatly and frequently;
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% of the margin, so that the whole machine can work stably for a long time;
- The module should be kept away from the parts with large electromagnetic interference such as power supply, transformer and high-frequency wiring as far as possible;
- High-frequency digital traces, high-frequency analog traces, and power traces must avoid the underside of the module. If it is necessary to pass under the module, assuming that the module is soldered on the Top Layer, lay copper on the Top Layer of the contact part of the module (all copper). And well grounded), it must be close to the digital part of the module and routed on the Bottom Layer;
- Assuming that the module is soldered or placed on the Top Layer, it is also wrong to arbitrarily route wires on the Bottom Layer or other layers, which will affect the stray and receiving sensitivity of the module to varying degrees;
- Assuming that there are devices with large electromagnetic interference around the module, it will also greatly affect the performance of the module. It is recommended to stay away from the module according to the intensity of the interference. If the situation allows, appropriate isolation and shielding can be done;
- Assuming that there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power traces), it will also greatly affect the performance of the module. It is recommended to stay away from the module according to the intensity of the interference. Proper isolation and shielding;
- If the communication line uses 5V level, a 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage);
- The antenna installation structure has a great impact on the performance of the module. Make sure that the antenna is exposed and it is best to vertically upward;
- When the module is installed inside the casing, a high-quality antenna extension cable can be used to extend the antenna to the outside of the casing;
- The antenna must not be installed inside the metal shell, which will greatly weaken the transmission distance.

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IX. Common Issue

9.1 The transmission distance is not ideal

- When there is a straight line communication obstacle, the communication distance will be correspondingly attenuated;
- Temperature, humidity, and co-channel interference will increase the communication packet loss rate;
- The ground absorbs and reflects radio waves, and the test effect close to the ground is poor;
- Seawater has a strong ability to absorb radio waves, so the seaside test effect is poor;
- There are metal objects near the antenna, or placed in a metal shell, the signal attenuation will be very serious;
- The power register is set incorrectly, and the air rate is set too high (the higher the air rate, the closer the distance);
- The low voltage of the power supply at room temperature is lower than the recommended value, and the lower the voltage, the lower the output power;
- The matching between the antenna and the module is poor or the quality of the antenna itself is problematic..

9.2 Module is easily damaged

- Please check the power supply to ensure that it is between the recommended power supply voltages. If it exceeds the maximum value, the module will be permanently damaged;
- Please check the stability of the power supply, the voltage should not fluctuate greatly and frequently;
- Please ensure that the installation and use of anti-static operation, high-frequency components electrostatic sensitivity;
- Please ensure that the humidity during installation and use should not be too high, and some components are humidity-sensitive devices;
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.

9.3 Bit error rate too high

- There is co-frequency signal interference nearby, stay away from the interference source or modify the frequency and channel to avoid interference;
- Unsatisfactory power supply may also cause garbled characters, be sure to ensure the reliability of the power supply;
- The extension line and feeder line are of poor quality or too long, which will also cause a high bit error rate.

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X. Welding Work Guide

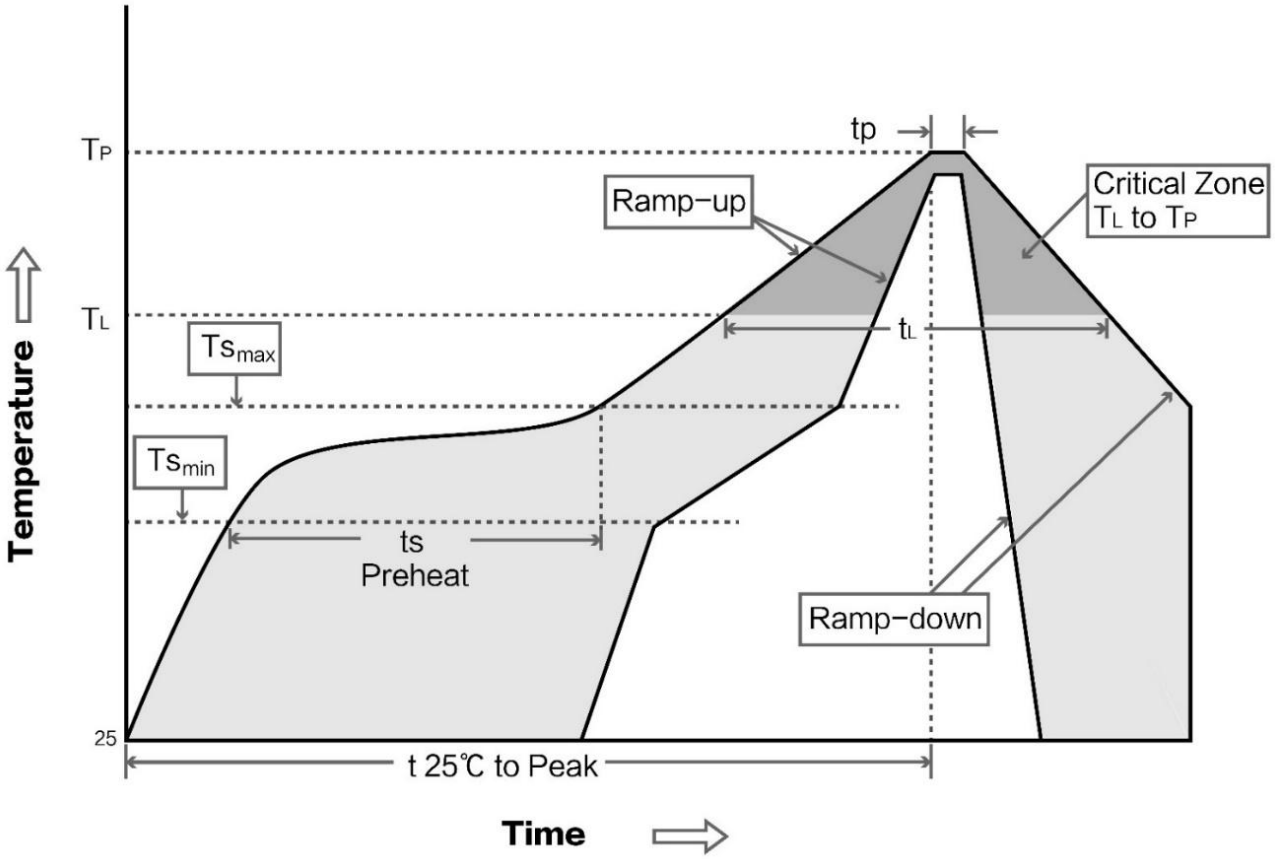
10.1 Reflow Temperature

Profile Feature	Curve feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	Preheat Temperature min （Tsmin）	100℃	150℃
Preheat temperature max (Tsmax)	Preheat temperature max (Tsmax)	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	Preheat Time (Tsmin to Tsmax)(ts)	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average ramp-up rate(Tsmax to Tp)	3℃/second max	3℃/second max
Liquidous Temperature (TL)	Liquidous Temperature (TL)	183℃	217℃
Time（tL）Maintained Above（TL）	Time（tL）Maintained Above（TL）	60-90 sec	30-90 sec
Peak temperature（Tp）	Peak temperature（Tp）	220-235℃	230-250℃
Aveage ramp-down rate（Tp to Tsmax）	Aveage ramp-down rate（Tp to Tsmax）	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time 25℃ to peak temperature	6 minutes max	8 minutes max

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10.2 Reflow Soldering Curve



XI. Antenna Guide

11.1 Antenna recommendation

Antennas play an important role in the communication process, and often inferior antennas will have a great impact on the communication system. Therefore, our company recommends some antennas as antennas with excellent performance and reasonable price for our wireless modules.

Product Model	Type	Band Hz	Interface	Gain dBi	Height mm	Feeder cm	Features
TX433-NP-4310	Flexible antenna	433M	Welding	2.0	43.8*9.5	-	Built in flexible, FPC soft antenna
TX433-JZ-5	Rubber rod antenna	433M	SMA-J	2.0	52	-	Ultra short straight, omnidirectional antenna
TX433-JZG-6	Rubber rod antenna	433M	SMA-J	2.5	62	-	Ultra short straight, omnidirectional antenna

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TX433-JW-5	Rubber rod antenna	433M	SMA-J	2.0	50	-	Bending rubber rod, omnidirectional antenna
TX433-JWG-7	Rubber rod antenna	433M	SMA-J	2.5	75	-	Bending rubber rod, omnidirectional antenna
TX433-JK-11	Rubber rod antenna	433M	SMA-J	2.5	110	-	Bendable rubber rod, omnidirectional antenna
TX433-JK-20	Rubber rod antenna	433M	SMA-J	3.0	210	-	Bendable rubber rod, omnidirectional antenna
TX433-XPL-100	Sucker antenna	433M	SMA-J	3.5	185	100	Small sucker antenna, cost performance
TX433-XP-200	Sucker antenna	433M	SMA-J	4.0	190	200	Neutral sucker antenna, low loss
TX433-XPH-300	Sucker antenna	433M	SMA-J	6.0	965	300	Large sucker antenna, high gain

Revision history

Version	Revision Date	Revision Description	Maintainer
1.0	2023-1-16	Initial version	Yan
1.1	2023-7-19	error corrected	Bin
1.2	2024-4-10	Bug fixes	Hao
1.3	2025-8-7	Bug fixes	Hao
1.4	2026-2-4	Bug fixes	Hao

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